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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/575,489	04/12/2006	Hiroshi Fukshima	P29715	1539

7055 7590 07/09/2009

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EXAMINER	
YANG, MINCHUL	
ART UNIT	PAPER NUMBER
2891	

NOTIFICATION DATE	DELIVERY MODE
07/09/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/575,489	FUKSHIMA ET AL.	
	Examiner	Art Unit	
	Minchul Yang	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *3/11/09*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-6,8-10,12 and 14-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-2, 4-6, 8-10, 12, and 14-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *2/5/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

105Detailed Action

1. Claims 1-2, 4-6, 8-10, 12, and 14-18 are pending in the application. Claims 3, 7, 11, and 13 are cancelled. Claims 1-2, 4-6, 8-10, 12, and 14-18 are examined in this Office action.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-2, 4-6, 10, and 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okazaki (US Patent 6495862), in view of Wierer (US Pub. 2005/0082545) and Weller (US Pub. 2002/0132083).

(a) Okazaki discloses a method of making an LED, comprising steps of:

Regarding claim(s) 1: forming a transfer layer on at least a part of the transparent crystal substrate or the light-emitting layer (col. 5, lines 31 -35), softening or setting said transfer layer upon supplying an energy thereto (col. 5, lines 43-46); forming a minute unevenness structure for preventing multiple reflection based on the minute unevenness structure transferred to the transfer layer (col. 5, lines 47-52);

Regarding claim(s) 2: separating the transparent crystal substrate from the light-emitting layer after a substrate bearing layer is formed on a surface of the light-emitting layer where

electrodes are to be formed (col. 13, lines 1-3).

(b) Regarding claim(s) 1, Okazaki discloses the features previously outlined, but does not expressly disclose the following limitation(s): pressing a mold formed with a minute unevenness structure against the transfer layer to transfer the minute unevenness structure to an outer surface of the transfer layer; dry etching the transfer layer with a chlorine gas using the transfer layer as a resist mask to form the minute unevenness structure.

However, Wierer teaches a method of making an LED comprising (see, e.g., figures 16-19 and related text) a step of pressing a mold formed with a minute unevenness structure (0056: the microcontact printing and nano-imprinting use a mold with a minute unevenness structure) against the transfer layer (202) to transfer the minute unevenness structure to an outer surface of the transfer layer (figure 17); dry etching (0056) the transfer layer with a chlorine gas (note that chlorine is a typical etchant gas for drying etching; see also Okazaki, col. 5, lines 48-58) using the transfer layer as a resist mask to form the minute unevenness structure (figure 18) for preventing the multiple reflection in the transparent crystal substrate or the light-emitting layer (the corrugated LED surface of Okazaki in view of Wierer is capable of preventing the multiple reflection). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to make the minute unevenness structure of Okazaki using the imprinting method of Wierer that could benefit to eliminate steps required in a photo-lithographic method and thereby reduce manufacturing time/cost.

(b) Regarding claim(s) 1 and 15-16, Okazaki in view of Wierer teach the features previously outlined, but do not expressly teach the following limitation(s): the transfer layer is from a silicon organic solvent comprising TEOS and one of alcohol, ester, and ketone. However,

it was well recognized in the art that TEOS was a typical material to form a patterned mask and used in a form of solution in alcohol, ester, or ketone. For instance, Weller teaches (0034) that a topographical pattern can be made by a nano-imprinting method, wherein a TEOS layer is deposited, imprinted to form a patterned mask, and etched to leave a patterned underlying surface. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a TEOS solution in alcohol, ester, or ketone for the transfer layer of Okazaki in view of Wierer, because TEOS was a typical material to form a patterned mask with a high adhesiveness and a suitable etching rate for the intended use.

(c) Regarding claim(s) 1, Okazaki in view of Wierer teach the features previously outlined, but do not expressly teach the following limitation(s): a pressing pressure of the mold is 5 MPa or higher and 150 MPa or lower.

However, it was well recognized in the art that a pressing pressure of a mold is one of parameters that determine a final structure of a resist in terms of pitch-to-pitch distances, height distributions, and regularities of the molded pattern in the resist. For instance, if the pressing pressure is too low, the molded pattern of the resist would have a less sharpness than that of the mold. If the pressing pressure is too high, the resist would be at risk of damage. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to one of ordinary skill in the art at the time the invention was made to use a pressing pressure in the claimed range in the imprinting method of Okazaki in view of Wierer for optimization. Examiner notes that: "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation": In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955); discovery of an optimum value of a result

effective variable in a known process is ordinarily within the skill of the art: In re Boesch, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980).

(d) Regarding claim(s) 4, Okazaki in view of Wierer and Weller teach the features previously outlined, but do not expressly teach the following limitation(s): the mold has an upper flat portion located near a bottom of the minute unevenness structure to be transferred and a lower flat portion located at a position about a thickness of an upper semiconductor layer of the light-emitting layer, the upper flat portion and the lower flat portion is transferred together with the minute unevenness structure to the transfer layer. This limitation has no patentable weight because the recited structural limitation does not affect the method in a manipulative sense, and merely claims a use of a particular structure (See, Ex parte Pfeiffer, 135 USPQ 31 (1961)).

Regarding the limitation "forming electrode-forming portions by etching the upper and lower semiconductor layers of the light-emitting layer when dry etching is carried out using the transfer layer as a resist mask", it would have been obvious to one of ordinary skill in the art at the time the invention was made to place electrodes at either end of the active layer, since it has been held that rearranging parts of an invention involves only routine skill in the art. In re Japikse, 86 USPQ 70.

(e) Regarding claim(s) 5, 10, and 17, Okazaki in view of Wierer and Weller teach the features previously outlined, but do not expressly teach the following limitation(s): adjusting a selection ratio of the etching speed of the light-emitting layer to that of the resist from twofold to fourfold; wherein the silicon organic solvent is applied at a thickness of 2 μm or greater.

However, it was well recognized in the art that a selection ratio of the etching speed between a resist and an underlying layer as well as the transfer layer thickness are parameters

that determine a final structure of the etched underlying layer in terms of pitch-to-pitch distances, height distributions, and regularities of the etched pattern in the underlying layer. For instance, if the etching speed of the resist is higher than that of the underlying layer, the etched pattern of the underlying layer would have a less sharpness than that of the pattern of the resist. A too thick transfer layer increases molding and etching time, while a too thin transfer layer increases the risk of etching the entire surface of the underlying surface. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust a selection ratio of the etching speed of the light-emitting layer to that of the resist from twofold to fourfold and the transfer layer thickness for optimization.

(f) Regarding claim(s) 6 and 14, Okazaki in view of Wierer and Weller teach the features previously outlined, but do not expressly teach the following limitation(s): applying the silicon organic solvent by potting or spray coating. It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the silicon organic solvent by potting or spray coating, because these are typical methods of forming a layer of a silicon organic solvent with a benefit of simplicity of the process.

(g) Regarding claim(s) 18, Okazaki in view of Wierer and Weller teach the features previously outlined, but do not expressly teach the following limitation(s): wherein the method further comprises post-baking the transfer layer at or below 120°C after the minute unevenness structure is transferred to the transfer layer. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to post-bake the transfer layer at or below 120°C after the minute unevenness structure is transferred to the transfer layer in order to harden the transfer layer and evaporate any liquid therein without damaging the structure.

4. Claims 8-9 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okazaki in view of Wierer and Weller, as applied to the claims above, and further in view of Holman (US Pub. 2004/0080938).

(a) Regarding claim(s) 8, Okazaki in view of Wierer and Weller teach the features previously outlined, but do not expressly teach the following limitation(s): “unevenness structure larger than the minute unevenness structure on the minute unevenness structure of the light-emitting layer”. However, Holman teaches, "unevenness structure larger than the minute unevenness structure on the minute unevenness structure of the light-emitting layer" for the benefit of well defined and controllable illumination (0038, and Fig. 3). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the unevenness structures of Holman in the method of Okazaki in view of Wierer and Weller for the benefit of well defined and controllable illumination.

(b) Regarding claim(s) 9, Okazaki in view of Wierer, Weller, and Holman teach the features previously outlined. Poicus further discloses the unevenness structure has the shape of a prism or a microlens (Fig. 9).

(c) Regarding claim(s) 12, Okazaki in view of Wierer and Weller teach the features previously outlined, but do not expressly teach, "unevenness structure larger than the minute unevenness structure on the minute unevenness structure of the light-emitting layer". However, Holman teaches, "unevenness structure larger than the minute unevenness structure on the minute unevenness structure of the light-emitting layer" for the benefit of well defined and controllable illumination (0038-0039, and Fig. 3). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the unevenness

structures of Holman with the method of Okazaki in view of Wierer and Weller for the benefit of well defined and controllable illumination.

Response to Arguments

5. Applicant's arguments filed on 3/11/09 have been considered but they are not persuasive.

(a) The declaration under 37 CFR 1.132 filed on 3/11/09 is insufficient to overcome the rejection for the following reasons.

Applicant states that a certain thickness range (1.5 μm or thicker) of the transfer layer is required, and achieving the thickness range requires non-routine forming steps including molding in a certain pressure range. Applicant explains that the requirement for the transfer layer thickness range is due to the requirement that the pitch of the mold should be about 3 μm, which is necessary to form a pitch of the uneven structure with the preferred dimension of 3 μm.

In response, Examiner notes that the pitch dimension of 3 μm for the uneven structure is not required for its intended use, which is to scatter light. One in the art could use a different dimension of pitch for the same intended use. For instance, even the pitch dimension of 0.5 μm could still effectively scatter a visible or a UV light. The pitch dimension of 0.5 μm requires a thickness of the transfer layer in a range much less than 1.5 μm, and therefore does not require the allegedly non-routine forming steps as described in the declaration. This reasoning is also supported by the declaration, showing in figure 3 that a transfer layer thickness of 1.2 μm can be achieved even by a single attempt of spin-coating, which is a routine forming step.

The declaration describes that certain dimensions including the dimension of the mold

pitch are required, but these critical dimensions are not recited in the claims. Examiner notes that a claim that omits an element which applicant describes as an essential or critical feature of the invention originally disclosed does not comply with the written description requirement (MPEP 2163).

Finally, even in the case of forming the transfer layer in the thickness range of 1.5 μm or larger, the declaration does not provide sufficient evidence to show that non-routine forming steps are required. Applicant states that this thickness range cannot be achieved by spin coating but can be achieved by potting. However, Examiner notes that potting was also one of well known methods for deposition, along with spin coating, dipping, and evaporation. Selecting one optimal method among conventional methods to make the transfer layer in an optimal thickness range is indeed part of routine experimentation. Once the optimal method was chosen, one in the art would have to choose a set of conditions for result-effective variables such as pressing pressure, which is also part of routine experimentation: the pressing pressure must be optimized because, if the pressing pressure is too low, the molded pattern of the resist would have a less sharpness than that of the mold, and if the pressing pressure is too high, the resist would be at risk of damage. The declaration states that finding the lower and upper limits of pressure (5 – 150 MPa) was not easy. Note that routine experimentation is not necessarily easy. The declaration does not provide sufficient factual evidence of showing that the pressure range provides either unexpected or critical results.

(b) Applicant argues: the Office Action recites steps of "forming a transfer layer..." and "forming a minute unevenness structure..." which are not expressly claimed in the pending claims; and to the extent that the Office Action paraphrases the language of the pending claims,

the Action fails to properly consider all words of the claim, and as such, fails to teach each and every element of the pending claims. In response, the Office Action recites steps of "forming a transfer layer..." and "forming a minute unevenness structure..." in order to address what the primary reference of Okazaki alone teaches. As addressed in the Office action, all the limitations are taught and/or suggested by Okazaki in view of Wierer and Weller. Applicant fails to specify which limitation is not taught or suggested by Okazaki in view of Wierer and Weller.

(c) Applicant argues that the Office Action does not establish that there is a reasonable expectation, nor any degree of predictability, that the combination set forth by the Office Action would be successful. However, Applicant fails to specify which teaching or suggestion of the cited references has no reasonable expectation of success. In addition, Examiner is not required to prove that there is a reasonable expectation of success, unless Applicant provides sufficient reasoning or evidence to show why this is not the case.

(d) Applicant argues that the declaration is effective to show that the Office action fails to show a reasonable expectation of success. However, as addressed above, the declaration only states a certain pressure condition is required for a certain pitch dimension, which is not necessary condition for the intended use, nor is recited in the claims.

(e) Applicant argues that the cited documents fail to recognize that pressure as a result effective variable, and absent any indication from the cited art that pressure is, in fact, a result-effective variable, any allegation by the Office that optimization of pressure would be obvious is an improper basis for rejection. However, Examiner provided sufficient reasoning why pressure was a result-effective variable. Applicant does not dispute this reasoning. Moreover, as addressed in the Advisory action, this reasoning is supported by references. For instance, Chou

teaches a pressing step and specifically mentions a pressure conditon of 600-1900 psi (= 4.2-13.3 MPa: page 4129, col. 2, last paragraph). Note that this range overlaps the claimed range (5-150 MPa). Chou further teaches in the same paragraph that the pressing pressure depends on the molded material used. Hirai teaches a pressing step under stamping pressures of 30, 60, 90 MPa (figure 6). Hirai furhter analyzes in detail how the pressing pressure affects the final structure of the molded material (see, e.g., Introduction, figures 2-6, and Result and Discussions). Applicant does not dispute regarding these references..

(f) Applicant argues that the alleged reduction in manufacturing time or cost as set forth by the Office action is not expressed as a benefit of either document. However, Examiner provided sufficient reasoning why this is the case by comparing with a photo-lithographic method. Applicant does not dispute this reasoning.

(g) Applicant argues that Okazaki, Wierer, and Weller are not properly combinable: this is because "the resist layer used in Okazaki has a specific benefit of being softened to have a semi-circular cross section (Figure 2c) prior to etching...it is this softened state pattern which is desired in Okazaki (Col. 5, lines 48-56)...Subsequently pressing a mold formed with a minute unevenness structure against the transfer layer would destroy the structural integrity of the pattern to be transferred in Okazaki". This is not persuasive at least one of the following reasons. First, in the method of Okazaki in view of Wierer and Weller, the Wierer teaching of patterning a transfer layer by molding replaces the Okazaki step of patterning a transfer layer by photo-lithography. Therefore, the step of pressing a mold against a transfer layer is performed before the step of softening or setting the transfer layer of Okazaki, and thereby does not damage the transfer layer of Okazaki. Second, the Weller patterning step, including molding followed by

etching, does not need the Okazaki softening step to form a semi-circular cross section, but needs a pre-softening step before molding in order to increase viscosity of the transfer layer. In this case, a teaching of softening a transfer layer before molding comes from Wierer not from Okazaki, and therefore the Applicant's argument is not relevant.

(h) Applicant argues that one in the art would not have considered Weller as analogous art because Weller is directed to magnetic recording media having self organized magnetic arrays. However, Examiner notes that the patterning methods in Okazaki and Weller are in the analogous art in that both methods are designed to form a patterned surface and generate similar structures to each other. Even if they were not in the analogous art, arguendo, the obviousness would still hold because the patterning technique of Weller would have commended itself to one's attention in any art whose invention requires forming a patterned surface (see, e.g., MPEP 2141.01(a)). Examiner also notes that the Weller reference is cited to provide evidence that TEOS was a typical material to form a patterned mask in an imprinting method.

(i) The term "anticipated by" in the heading of the first Office action is now corrected as "unpatentable over".

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Minchul Yang whose telephone number is (571) 270-1750. The examiner can normally be reached on Monday through Friday 7:30 AM - 5:00 PM E.S.T..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kiesha Rose can be reached on (571) 272 -1844. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. Y./

Examiner, Art Unit 2891

/Kiesha L. Rose/

Supervisory Patent Examiner, Art Unit 2891